

REMARKS

I. Introduction

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection Of Claims 1, 2 And 6 Under 35 U.S.C. § 103

Claims 1, 2 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Inoue (USP 5,707,756). Applicants respectfully traverse this rejection for at least the following reasons.

With regard to the present disclosure, claim 1 recites, in-part, a non-aqueous electrolyte secondary battery comprising a positive electrode material mixture layer which comprises a positive electrode active material comprising a lithium transition metal composite oxide, the lithium transition metal composite oxide comprising lithium, a transition metal, and a metal different from the transition metal, an end of charge voltage of said non-aqueous electrolyte secondary battery is set to 4.25 to 4.5 V in normal operation, and the ratio R:Wp/Wn is 1.3 to 2.2 in the area where said positive electrode material mixture layer and said negative electrode material mixture layer are opposed to each other, said Wp being the weight of the positive electrode active material contained in said positive electrode material mixture layer per unit opposed area, said Wn being the weight of the negative electrode active material contained in said negative electrode material mixture layer per unit opposed area.

Two features of the present disclosure are that the positive electrode active material comprises a lithium composite oxide containing a different metal and that the weight ratio of the active material contained in the positive electrode to the active material contained in the negative

electrode is 1.3 to 2.2. With this claimed weight ratio, the negative electrode will have regions on its surface that are opposed to the positive electrode, and those that are not opposed to the positive electrode. The reason for this is to prevent deposition of lithium metal which is desorbed from the positive electrode during charge and is then absorbed by the negative electrode. The lithium metal does not participate in the charge and discharge reactions. Thus, as the amount of deposited lithium metal increases, the capacity of the battery decreases, which leads to a decrease in the output and life of the battery.

In the present disclosure, the weight ratio R of the active material contained in the area where the positive electrode and the negative electrode are opposed to each other is set in a specific range. Further, the lithium composite oxide containing a different metal as the second feature is used as the positive electrode active material. That is, a combination of the features of the lithium composite oxide containing a different metal and the claimed weight ratio improves the charge and discharge cycle characteristics, and in terms of the safety of the battery, an effect of decreasing the thermorunaway temperature is achieved. This effect is supported in Tables 2 and 3 of the specification.

As is shown in Table 2, the combination of the above cited features make the capacity maintenance rate as high as 80% (see, Batteries 2-7). In contrast, as shown in Battery 1, when the weight ratio R is lower than 1.3, a decrease in the capacity maintenance rate is observed even with the use of a lithium composite oxide containing a different metal. For example, in Battery 1, when the end of charge voltage is set to 4.5 V, the capacity maintenance rate is decreased to 70%. In addition, when R is greater than 2.2, the capacity maintenance rate is 70% or lower (see, Batteries 8 and 9 in Table 2). In addition, even if R is within the claimed range, such as 2.0

or 1.5, when a lithium composite oxide containing a different metal is not used, the capacity maintenance rate is 45% or lower (see, Batteries A and B).

In addition, Table 3 of the present disclosure shows the evaluation results of the thermorunaway temperature. A comparison is made with a charge voltage of 4.4 V. Again, if the two features of the lithium composite oxide containing a different metal and the claimed weight ratio are combined, the thermorunaway does not begin under 170 °C in most of the batteries. In contrast, when R is less than 1.3 or greater than 2.2, the thermorunaway is from 150 to 160 °C even if a different metal is used. In addition, even if R is within the claimed range, the thermorunaway starts at around 140 °C if a different metal is not used in the lithium composite oxide.

Thus, it is clear that the two combined features result in unexpected superior results. Moreover, these results are not taught or suggested in the cited prior art. It is admitted that Inoue fails to disclose the claimed weight ratio of positive to negative electrode materials. However, it is alleged that Inoue teaches in column 33, lines 36-59 is that the weight ratio of the positive electrode active material to the negative electrode active material can be optimized to improve the capacity, cycle life and safety of the battery. However, Inoue is not specific with regard to any ratio which discloses the above unexpected results of the present disclosure. In addition, “safety” of a battery may have a wide range of definitions. Thus, one skilled in the art would not use, for example, the technique of the prevention of explosion, for the prevention of thermorunaway.

Furthermore, Inoue describes in col. 33 that the width ratio of the negative electrode sheet to the positive electrode sheet is in a range of preferably 0.9 to 1.1 and more preferably 0.95 to 1.0. Thus, the negative electrode sheet is smaller than the positive electrode sheet in the battery

of Inoue. Thus, as Inoue fails to disclose the claimed ratio, and as Inoue fails to address the specific concerns about thermorunaway, it is clear that one skilled in the art would not utilize Inoue to obtain the claimed invention.

Moreover, neither Lu, Shoichiro, nor Fernandez are relied upon to remedy this deficiency. As such, it is clear that claim 1 is not taught or suggested by Inoue.

In order to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. As Inoue, at a minimum, fails to disclose a non-aqueous electrolyte secondary battery comprising a positive electrode material mixture layer which comprises a positive electrode active material comprising a lithium transition metal composite oxide, the lithium transition metal composite oxide comprising lithium, a transition metal, and a metal different from the transition metal, an end of charge voltage of said non-aqueous electrolyte secondary battery is set to 4.25 to 4.5 V in normal operation, and the ratio R:Wp/Wn is 1.3 to 2.2 in the area where said positive electrode material mixture layer and said negative electrode material mixture layer are opposed to each other, it is submitted Inoue does not render claim 1 obvious. Accordingly, claim 1 is allowable and as such, it is respectfully requested that the § 103 rejection of claim 1, and any pending claims dependent thereon be withdrawn.

**III. All Dependent Claims Are Allowable Because The
Independent Claim From Which They Depend Is Allowable**

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claim 1 is patentable for the reasons

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set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance.

IV. Conclusion

Having responded to all open issues set forth in the Office Action, it is respectfully submitted that all claims are in condition for allowance.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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